ELECTRONICS FOR MEASUREMENT • COMPUTATION • TELEMETRY • CONTROL

INSTRUCTION MANUAL

for

VOLTAGE CONTROLLED OSCILLATOR
MODEL GOV-3

DCS DATA-CONTROL SYSTEMS INC.

Instrumentation for Research

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DATA CONTROL SYSTEMS, INC., EAST LIBERTY STREET, DANBURY, CONNECTICUT

COMPOSITION PAGE

INSTRUCTION MANUAL

VOLTAGE CONTROLLED OSCILLATOR

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This instruction manual consists of the following pages:

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A

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Figure 1-1. Voltage Controlled Oscillator, Model GOV-3

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. PURPOSE AND SCOPE.

1-2. This publication contains a general description with installation, operation and maintenance instructions for the GOV-3, Voltage Controlled Oscillator, designed and manufactured by Data Control Systems, Inc., East Liberty Street, Danbury, Connecticut.

1-3. A general discussion of the electrical and physical characteristics, with a functional description of the GOV-3 is contained in Section I. Sections II and III cover Installation and Operation, respectively. A list of the required test equipment, preventive maintenance to be performed periodically and troubleshooting are given in Section IV, Maintenance. Section V contains drawings. Material requiring further clarification is illustrated with line drawings, halftones or listed in tabular form where necessary.

1-4. INTRODUCTION.

1-5. Model GOV-3 is a transistorized, voltage controlled oscillator used in installations where the outputs of various types of transducers must be converted to frequency modulated signals. Input span may be selected at ±2.5 volts or 0 to +5 volts for deviations of 16% and below. Above 16% deviation the input is ±2.5 volts. The GOV-3 is designed for use with DCS UNIDAP data systems in conjunction with the GMA Module Assembly. All IRIG channels and DCS Constant Bandwidth frequencies may be used. Table 1-1 and Table 1-2 list the IRIG channels and the Constant Bandwidth frequencies, respectively. The Constant Bandwidth system is a distinct advantage where it is necessary to multiplex the output of many identical transducers with precise time correlation between channels. It also permits more high frequency data recording on tape permitting greater bandwidth utilization. Figure 1-2 shows a block diagram of the GOV-3 used in a five channel constant bandwidth system.

1-6. VOLTAGE CONTROLLED OSCILLATOR, MODEL GOV-3.

1-7. The GOV-3 is a wide range oscillator used to convert constant or time-varying analog input voltages to a frequency modulated subcarrier. The unit may be used singly for wide deviation recording of a single carrier per tape recorder track or in a combination with other units to form a multiplex signal. The GOV-3 operates with deviations of 4.7% to 40%. Center frequency and deviations are determined by a modular plug-in unit, Model GOV-3/F or GOV-3/FS.

Table 1-1. IRIG Constant Percentage Deviation Frequency System

Band	Center Frequency (cps)	Deviation (cps)	Lower Limit* (cps)	Upper Limit* (cps)	Maximum Deviation (percent)	Maximum Intelligence Frequency (Modulation Index 5) (cps)
1	400	±30	370	430	±7.5	6.0
2	560	42	518	602	±7.5	8.4
3	730	55	675	785	±7.5	11
4	960	72	888	1,032	±7.5	14
5	1,300	98	1,202	1,399	±7.5	20
6	1,700	128	1,572	1,828	±7.5	25
7	2,300	173	2,127	2,473	±7.5	35
8	3,000	225	2,775	3,225	±7.5	45
9	3,900	293	3,607	4,193	±7.5	59
10	5,400	405	4,995	5,805	±7.5	81
11	7,350	551	6,799	7,901	±7.5	110
12	10,500	788	9,712	11,288	±7.5	160
13	14,500	1,088	13,412	15,588	±7.5	220
14	22,000	1,650	20,350	23,650	±7.5	330
15	30,000	2,250	27,750	32,250	±7.5	450
16	40,000	3,000	37,000	43,000	±7.5	600
17	52,500	3,940	48,562	56,438	±7.5	790
18	70,000	5,250	64,750	75,250	±7.5	1,050
19	93,000	6,975	86,025	99,975	±7.5	1,400
20	124,000	9,300	114,700	133,300	±7.5	1,900
21	165,000	12,375	152,625	177,375	±7.5	2,500
A**	22,000	3,300	18,700	25,300	±15	660
B	30,000	4,500	25,500	34,500	±15	900
C	40,000	6,000	34,000	46,000	±15	1,200
D	52,500	7,880	44,625	60,375	±15	1,600
E	70,000	10,500	59,500	80,500	±15	2,100
F	93,000	13,950	79,050	106,950	±15	2,800
G	124,000	18,600	105,400	142,600	±15	3,700
H	165,000	24,750	140,250	189,750	±15	5,000

* Rounded off to nearest cycle.

** Bands A through H are optional and may be used by omitting adjacent bands as shown in the following table. In the process of recording the foregoing subcarriers on magnetic tape at a receiving station, provision may also be made to record a tape-speed-control tone and tape-speed-error-compensation signals.

Band used	Omit bands —
A	13, 15 and B
B	14, 16, A and C
C	15, 17, B and D
D	16, 18, C and E
E	17, 19, D and F
F	18, 20, E and G
G	19, 21, F and H
H	20 and G

If a 100 KC tape speed compensation tone is mixed with these bands, the 93 KC band must be omitted and the 124 KC band must not be deviated ±15%.

Table 1-2. DCS Constant Bandwidth Deviation Standards

Band	Center Frequency (kc)	Deviation (kc)	Frequency Response (kc) m 2	m 5
1C	12.5	±2	1	0.4
2C	20.8	±2	1	0.4
3C	29.2	±2	1	0.4
4C	37.5	±2	1	0.4
5C	45.8	±2	1	0.4
6C	54.2	±2	1	0.4
7C	62.5	±2	1	0.4
8C	70.8	±2	1	0.4
9C	79.2	±2	1	0.4
10C	87.5	±2	1	0.4
11C	95.8	±2	1	0.4
12C	104.2	±2	1	0.4
13C	112.5	±2	1	0.4
14C	120.8	±2	1	0.4
15C	129.2	±2	1	0.4
16C	137.5	±2	1	0.4
17C	145.8	±2	1	0.4
18C	154.2	±2	1	0.4
19C	162.5	±2	1	0.4
20C	170.8	±2	1	0.4
21C	179.2	±2	1	0.4
22C	187.5	±2	1	0.4
2CW	20.8	±4	2	0.8
4CW	37.5	±4	2	0.8
6CW	54.2	±4	2	0.8
8CW	70.8	±4	2	0.8
10CW	87.5	±4	2	0.8
12CW	104.2	±4	2	0.8
14CW	120.8	±4	2	0.8
16CW	137.5	±4	2	0.8
18CW	154.2	±4	2	0.8
20CW	170.8	±4	2	0.8
22CW	187.5	±4	2	0.8

Note 1. The number of these channels that may be transmitted over an RF link simultaneously will be limited by the available transmitter deviation.

Note 2. The bands with ±4-kc deviation will be designated with the suffix W.

Note 3. The even numbered wide deviation bands, 2CW through 22CW, are optional and may be used by omitting the adjacent odd numbered narrow bands.

DCS CONSTANT-BANDWIDTH SYSTEMS

Deviation	±62.5 cps	±125 cps	±250 cps	±500 cps	±1 kc	±2 kc	±4 kc	±8 kc	±16 kc	±32 kc	±64 kc
Center Frequencies	391 cps	781 cps	1.56 kc	3.13 kc	6.25 kc	12.5 kc	25 kc	50 kc	100 kc	200 kc	400 kc
	625 cps	1.25 kc	2.50 kc	5.00 kc	10.00 kc	20.0 kc	40 kc	80 kc	160 kc	320 kc	640 kc
	859 cps	1.72 kc	3.44 kc	6.88 kc	13.8 kc	27.5 kc	55 kc	110 kc	220 kc	440 kc	880 kc
	1.09 kc	2.19 kc	4.38 kc	8.75 kc	17.50 kc	35.0 kc	70 kc	140 kc	280 kc	560 kc	1.12 mc
	1.33 kc	2.66 kc	5.31 kc	10.60 kc	21.3 kc	42.5 kc	85 kc	170 kc	340 kc	680 kc	1.36 mc

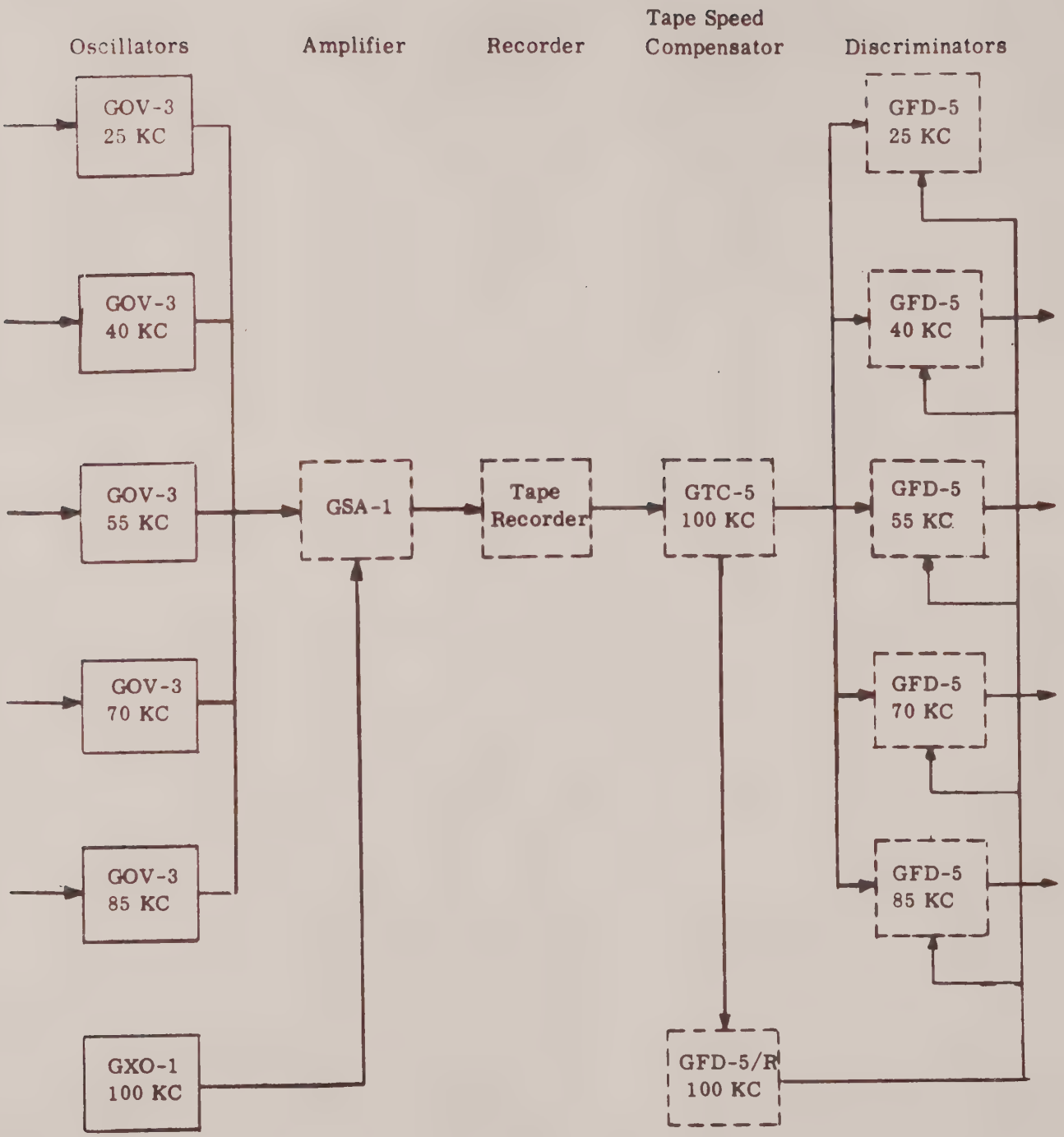


Figure 1-2. GOV-3 used with Five Channel Constant Bandwidth Systems

1-8. PHYSICAL CHARACTERISTICS. The GOV-3 (see Figure 1-3) is housed in a light weight aluminum cover. The total weight of the GOV-3 is 13 ounces and measures 1.14" wide x 3.29" high x 10.38" long. The GOV-3/F and GOV-3/FS plug-in and measure 1.06" wide x 1.751" high x 6.2" long. The GOV-3/F and GOV-3/FS plug into the side of the GOV-3 and in turn both fit into a single module of the GMA Module Assembly.

1-9. Primary parts of the GOV-3 are the front panel assembly and the VCO board which is also the main connector board. The front panel presents a gain control pot, a zero control pot and two monitor jacks. A captivated screw is also provided for locking the GOV-3 to the GMA. The window on the front panel is to enable viewing the frequency and deviation of the GOV-3/F plug-in unit. The main connector board is fastened to the chassis and is separated from it by insulation material. All circuitry is mounted on the VCO board with the exception of the plug-in unit which is connected to the main board by 14 Elco pins. The Elco pins mounted at the rear of the board couple the module to the power supply connector within the GMA.

1-10. COLOR. Color is aluminum with a brushed satin finish. Lettering is black.

1-11. ELECTRICAL CHARACTERISTICS. The GOV-3 operates at center frequencies from 200 cps to 1.5 megacycles with deviations from 4.7% to 40%. Voltage output at the summing bus is 0.16 V RMS nominal. Output impedance is 200 ohms. Deviation linearity for all deviations and input levels is ±0.1% of full bandwidth from best straight line.

1-12. Output distortion is less than 0.5% for deviations less than 16%. Intelligence frequency components in the summing bus are less than 0.1% of subcarrier level for full modulation at maximum rated channel intelligence frequency. Stability of the unit is ±0.5% of bandwidth for 12 hours at ±2°C temperature change after a 15 minute stabilization period.

1-13. In combination with the power supply in the GMA, the GOV-3 provides stability of better than 0.1% of bandwidth for 10% change in line voltage for zero input. Deviation sensitivity changes 1% for a 10% change in line voltage.

1-14. Input voltage for units with deviations of 16% and below is 0 to +5 volts or ±2.5 volts. For units with greater than 16% deviation input voltage is ±2.5 volts only. Input impedance for single ended input is 100 K ohms nominal shunted by approximately 30 pf.

1-15. INTERCONNECTION. External connection with the GMA is made through the Elco pins seated in the rear of the VCO board. Pin numbers and their designations are shown in Table 1-3.

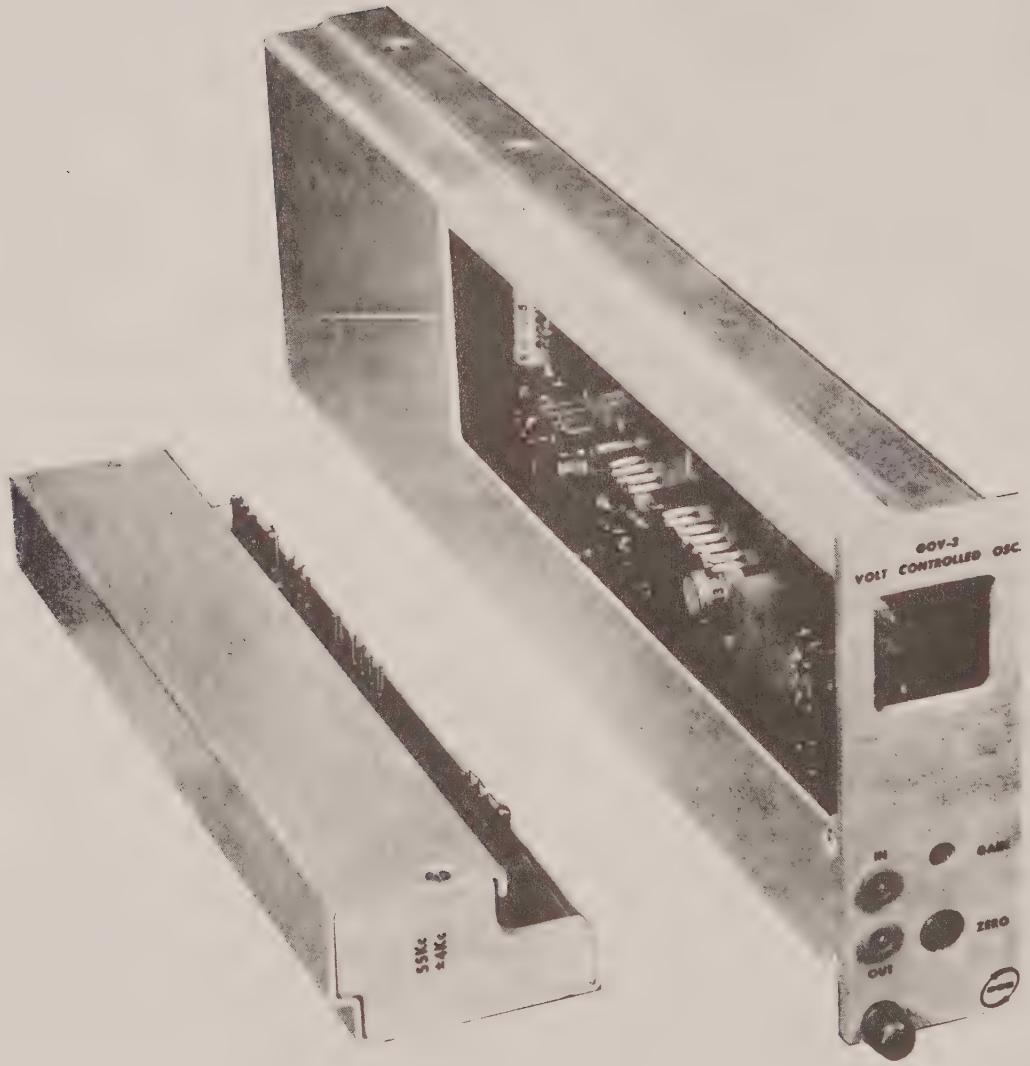


Figure 1-3. GOV-3 with plug-in removed

Table 1-3. Pin Connections

Pin No.	Designation
1	Signal Input
2	Signal Input Ground
3	+35 V
4	+12 V
5	Ground
6	Signal Output (Summing)
7	No Connection
8	-35 V
9	No Connection
10	No Connection
11	No Connection
12	No Connection
13	No Connection
14	No Connection
15	No Connection
16	No Connection
17	No Connection
18	No Connection
19	High Level Out
20	High Level Out Ground

1-16. GOV-3/FS is a switchable deviation filter used with the five upper bands of the IRIG frequencies where a 7.5% or 15% deviation is utilized. Components concerned are so marked on drawing DW-009553.

1-17. FUNCTIONAL DESCRIPTION.

1-18. Overall circuitry for the GOV-3 includes an input amplifier, a multivibrator consisting of a modulated current source and a current switch, a filter and an output stage. (See Figure 1-4.) Selection of plug-in circuitry, GOV-3/F or GOV-3/FS adapts the unit for operation at a specific center frequency and deviation.

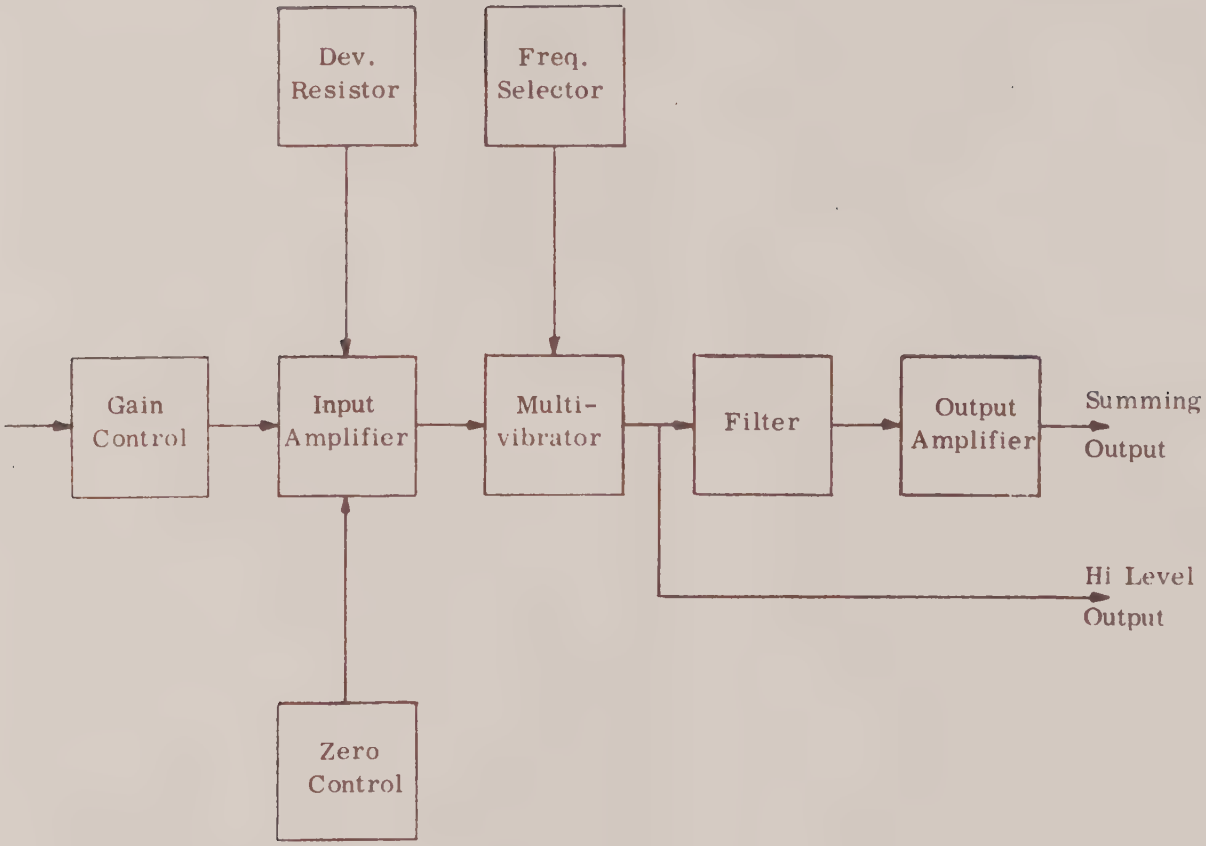


Figure 1-4. GOV-3, Block Diagram

1-19. INPUT AMPLIFIER. Emitter-follower Q201 and Darlington coupled gain stage Q202, Q203 compose the input amplifier.

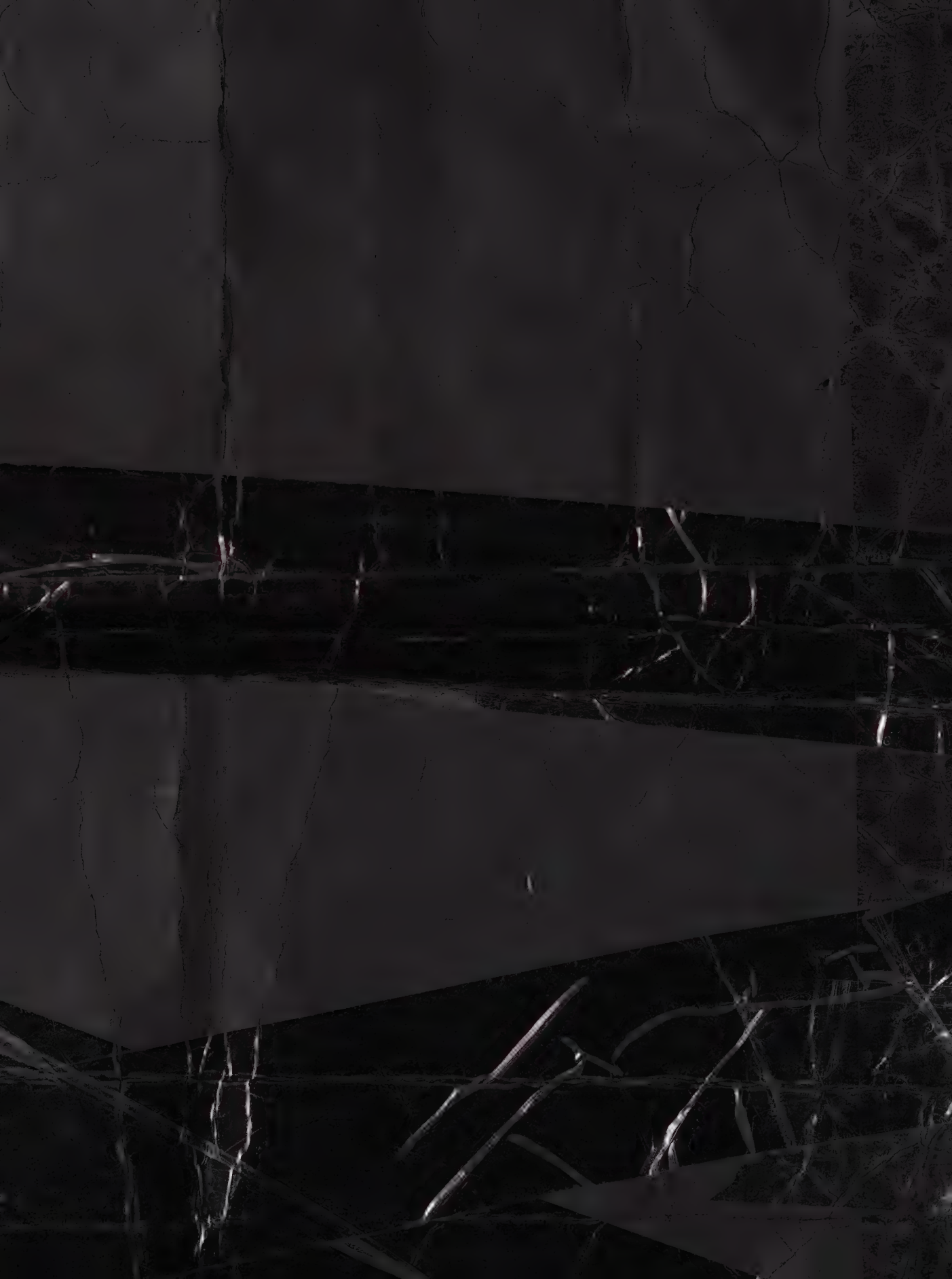
1-20. The input signal is applied directly to gain control R201 as shown in Figure 1-5. The shield is grounded only at R102 to reduce ground loops and common impedance problems. R204 and R203 buck out the base current at Q201 which, with a high source impedance, would develop a voltage across R201. Deviation sensitivity resistor R1203 determines the gain of the amplifier by the ratio of R209 and R1203. Q201 and CR201 junctions act to temperature compensate the base-emitter junctions of Q202 and Q203.

1-21. MULTIVIBRATOR. VCO circuitry is composed of two identical current sources Q303, Q301 and Q304, Q302, emitter coupled switches Q305, Q306, clamps CR305, CR306 and CR307, CR308, and timing capacitor C1301.

1-22. The signal from the input amplifier appears at the bases of the current sources causing a corresponding change in collector currents. Diodes CR301 and CR302 temperature compensate for the emitter-base junctions of the current sources.

1-23. Operation of the VCO may be visualized by assuming that Q305 is conducting and Q306 is off. The Q305 collector is clamped to ground through CR305. Q306 has its collector clamped thru CR308 to a voltage determined by the zero control potentiometer R312 through Darlington emitter-followers Q307 and Q308. The junctions of the clamp diodes are temperature compensated by the emitter-base junctions of Q307 and Q308. The collector of Q305, clamped to ground, is coupled to the base of Q306, now in the off condition, through zener diode CR304. Current from the Q303, Q301 current source is being conducted through Q305 with the charging current from C1301 from Q304, Q302. Charging the timing capacitor C1301 from a current source causes a theoretical, linear rate of change in the voltage across it. When this voltage equals the voltage on the emitter of Q306 the transistor will conduct, and the collector voltage will be clamped to ground through CR306. Q305 will be cutoff since the Q306 collector voltage is coupled to its base through zener diode CR303. The Q305 collector is caught by the clamp diode CR307 when it is in the off condition. At this time the current in C1301 has reversed and one half cycle has been completed.

1-24. The amplitude of the triangular waveform seen across C1301 is twice the amplitude of the difference between clamp voltages. With no modulation at the current sources, C1301 charges in one direction and then the other between the two clamp voltages. If the zero control



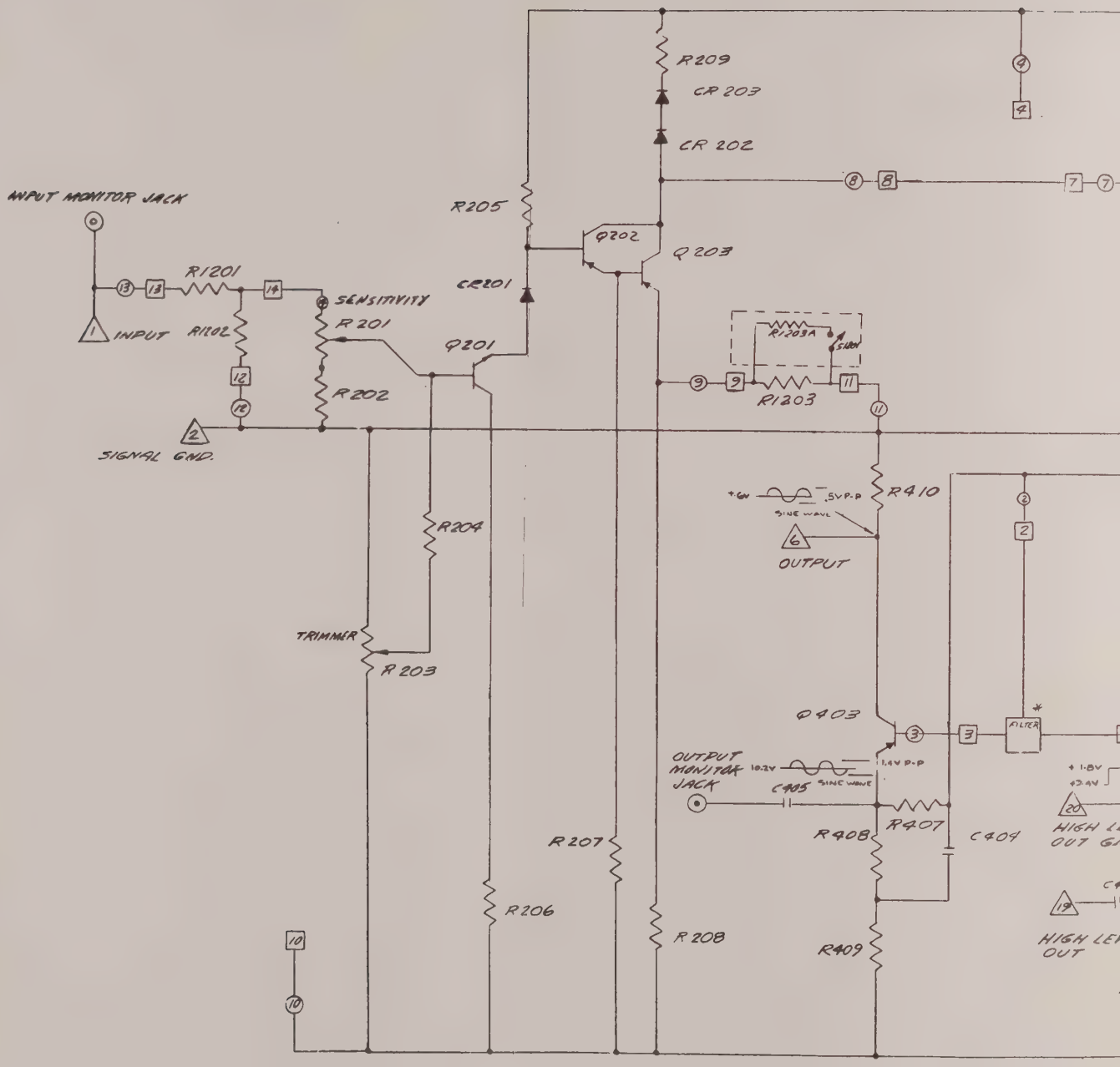
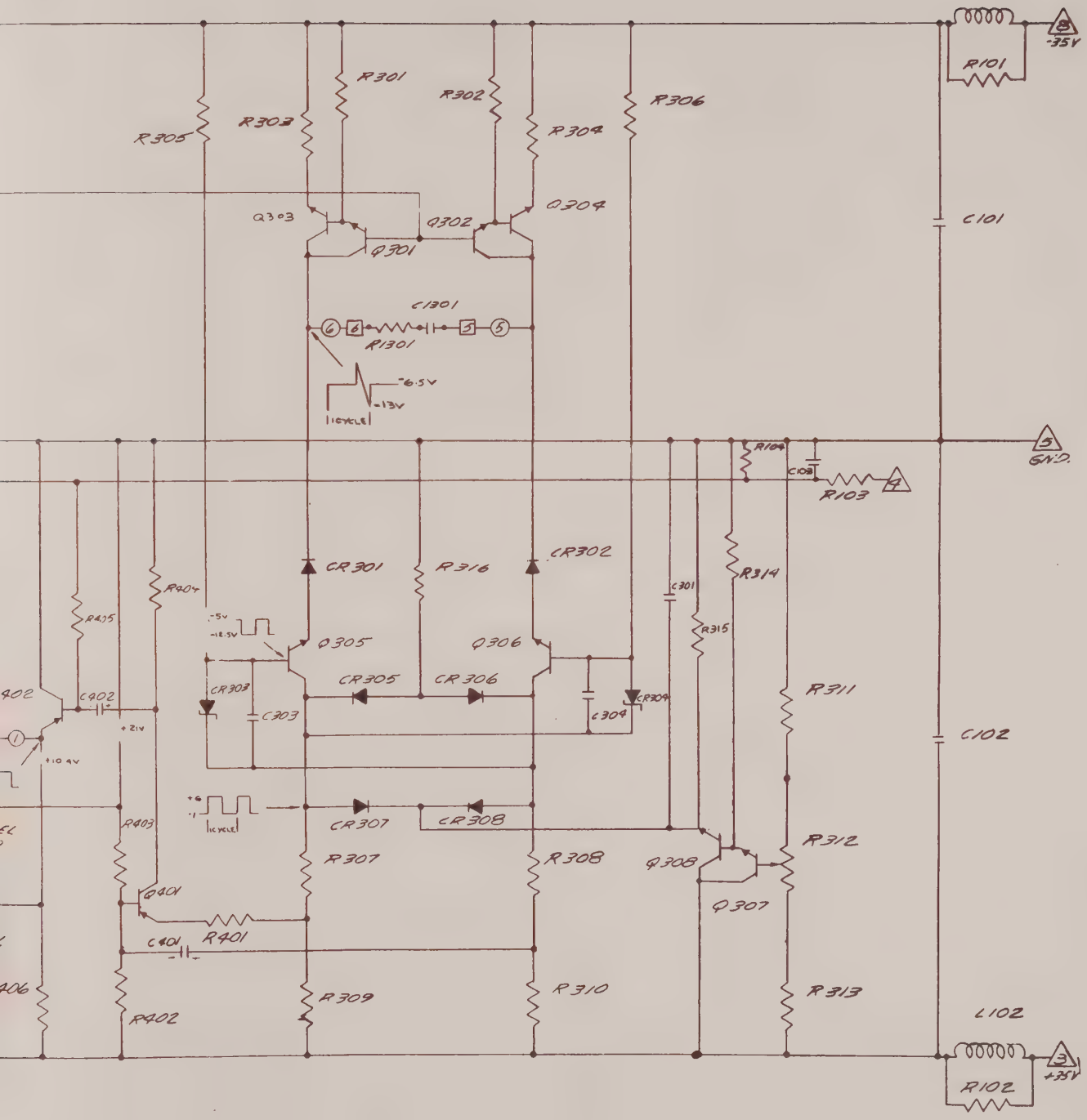


Figure 1-5. Simplified Schematic, GOV-3


R305
R303
R301
R302
R304
R306
R101
-35V
Q303
Q301
Q302
Q304
C101
C1301
R1301
-6.5V
-13V
1 CYCLE
R104
C103
R103
GND.
CR301
R316
CR302
R314
C301
R315
R405
R407
-5V
-12.5V
Q305
Q306
CR303
CR305
CR306
CR304
C303
C304
R311
C902
+21V
+10.4V
C102
+6
-1
1 CYCLE
CR307
CR308
R403
R307
R308
Q308
R312
Q401
Q307
C401
R401
R309
R310
R313
R402
L102
R102
+35V

is adjusted so that the difference between the clamp voltages decreases, the frequency will increase. Conversely, a zero adjustment increasing the difference between the clamp voltages will cause the frequency to decrease.

1-25. Modulation of the current sources causes a change in the C1301 charging slope. The multivibrator is frequency modulated when any change in the rate of change in voltage across C1301 occurs, because the timing capacitor is charging between precise clamp voltages.

1-26. OUTPUT SECTION. The output of the multivibrator is fed to Q401 for waveform preservation and through coupling capacitor C402 to emitter-follower Q402 which drives the filter and the high level square wave output at pin 20. After filtering, the sine wave output is amplified by Q403 and taken off at pin 6 whereas the output monitor jack is separated from the dynamics of the circuit at the low impedance point or the emitter of Q403.

SECTION II

INSTALLATION

2-1. GENERAL.

2-2. This section covers installation of the GOV-3 and precludes initial calibration or any preliminary operating procedures.

2-3. UNPACKING AND HANDLING.

2-4. The unit is sealed in a moisture proof polyethelene bag and wrapped in Kimpack insulation to absorb shock during shipment. There are no accessories, cabling or hardware packed with the equipment.

2-5. Remove the corrugated carton and protective covering and perform a general visual inspection. Retain carton and covering until inspection is completed.

2-6. MOUNTING.

2-7. The GOV-3 is designed to be mounted in the GMA Module Assembly where the proper module designations are inscribed. The GMA must be wired in accordance with Table 1-2 to accommodate the GOV-3 connector configuration.

2-8. To install the GOV-3 in the GMA, proceed as follows:

a. Note the proper designation and match the protruding portion of the GOV-3 with the 1/2 inch groove in the GMA.
b. Slide the unit into the GMA until guide pins and Elco connectors mesh.
c. Fasten the captive screw to ensure proper connection of Elco connectors.

2-9. COOLING.

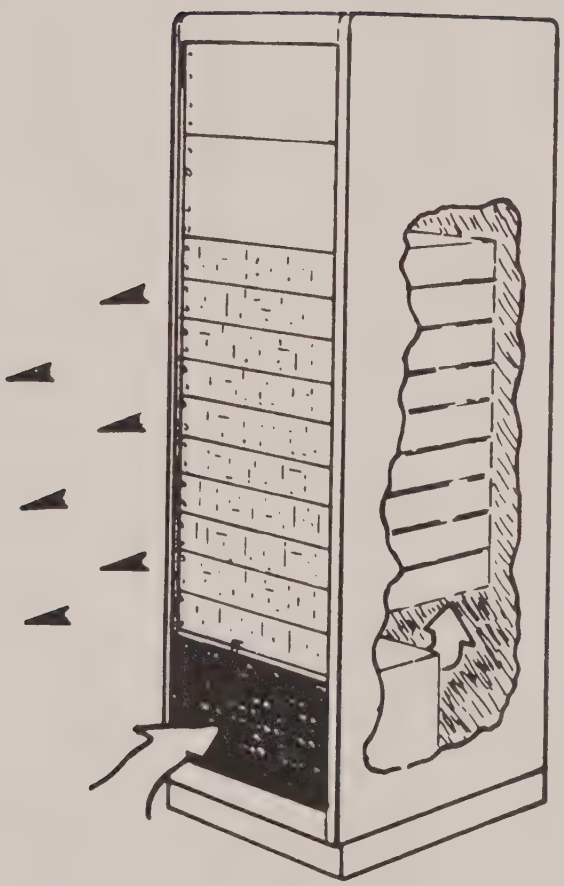
2-10. Cooling within the rack is an important consideration whenever stability is a critical factor. Environmental requirements acceptable for general purpose types of equipment are too broad and are not within the preferred temperature areas of this equipment. To attain proper cooling, racks must be pressurized.

2-11. Cooling is usually accomplished through a blower assembly located at the base of the cabinet. Adequate pressure is obtained by plugging all vents, screw holes and cracks, directing the flow of air through the module case and out through the crevices in the front panel.

(See Figure 2-1.) Each GMA is also equipped with a muffin fan which pressurizes to 0.2 inch of water and forces air over the GOV-3 and other units in the Module Assembly. Where ambient temperature does not exceed 40°C the muffin fan is adequate to maintain the necessary temperature within the GMA while it is being operated out of the rack.

2-12. When the GMA is positioned in the rack it is impossible to determine whether or not the muffin fans are operating with the main blower turned on. Energize all fans independently to assure they are operating. If the system is interlocked so that fans cannot be energized separately, bypass the switch.

2-13. Interconnection cables which are neatly grouped and arranged will also enhance the cooling problem since any blockage will decrease the rate of cooling air. As air constantly flows through the equipment, the main blower should always be properly filtered. If the rack heats up, although pressurized, and normal operation cannot be attained, replace the blower assembly filter even though it appears to be serviceable.



Air flow is 40 cfm per GMA . Installation shall be semi-pressurized to approximately 0.2 in. of water to permit cooling by air flow over and around units.

Figure 2-1. Typical Example of Rack Cooling

SECTION III

OPERATION

3-1. GENERAL.

3-2. This section covers the controls and monitor jacks, initial adjustment and the procedures required to place the GOV-3 in operation. It is assumed that the unit has been installed in the GMA as described in Section II, paragraph 2-8.

3-3. LOCATION AND FUNCTION OF CONTROLS AND PANEL JACKS.

3-4. Controls and panel jacks are listed in Table 3-1 and shown in Figure 3-1.

Table 3-1. Location and Function of Controls and Panel Jacks

Designation	Control and/or Panel Jack	Location	Function
R201	GAIN	Front Panel	Provides a sensitivity adjustment range of ±1/4 of the nominal value 50 K ohms
R312	ZERO	Front Panel	Provides a ±10% frequency adjustment to permit operation with symmetrical and asymmetrical input ranges. 1 K ohm
Blue Test Jack	OUTPUT	Front Panel	Output Monitor
Pin 1	INPUT	Front Panel	Input Monitor
R203	BIAS ADJ.	Lower Guide	To adjust the VCO so that the zero and sensitivity controls will not interact. 100 K ohms

3-5. NORMAL OPERATION. A single GOV-3 may be used for all IRIG and Constant Bandwidth channels by inserting the plug-in corresponding to the desired frequency.

3-6. Input span may be 0 to +5 volts or ±2.5 volts for units with a ±16% deviation or less. For deviations greater than ±16% only symmetrical input range is provided (±2.5 volts).

Figure 3-1. Front Panel View, GOV-3

3-7. To ensure proper action of the GOV-3, in the symmetrical position, proceed as follows:

a. Connect an electronic counter, Hewlett Packard 522 B or equivalent, to output of GOV-3 so as to monitor the output frequency.

b. With zero volts in, set the GOV-3 zero adjustment for center frequency of the plug-in unit.

c. Apply +2.5 volts to the GOV-3 and set the gain adjustment to low bandedge.

d. Apply a -2.5 volts to the GOV-3 and the counter should read high bandedge.

3-8. For proper action of the GOV-3 in the asymmetrical position proceed as follows:

a. Connect an electronic counter, Hewlett Packard 522 B or equivalent, to output of GOV-3 so as to monitor the output frequency.

b. With zero volts input, set the zero adjust to high bandedge.

c. Apply a +5 volts and set the gain adjust to low bandedge.

3-9. Bias adjustment may be attained by alternately opening and shorting the input of the GOV-3 and adjusting the bias control with the input open. This is a factory adjustment, but due to the ageing of Q201 it may eventually require readjustment. If improperly set, there will not be adverse effects on the overall operation of the GOV-3 but will merely require repeated switching from band center to bandedge for accurate calibration.

3-10. TURN-OFF PROCEDURE. To turn a single module off, disengage the Elco connectors between the GOV-3 and GMA by withdrawing the unit from the Module Assembly. To turn power off on all positions, the power switch at the rear of the GMA must be in the OFF position.

SECTION IV

MAINTENANCE

4-1. GENERAL.

4-2. This section describes the preventive maintenance necessary to ensure proper performance of the equipment. Troubleshooting is presented in a tabular form and the location of circuit sections and major components are pictorially referenced to permit ease in maintenance. (See Figure 4-1.)

4-3. TEST EQUIPMENT. Test equipment is listed in Table 4-1.

Table 4-1. List of Test Equipment

Nomenclature	Characteristics
Oscilloscope	Tektronixs 515A or equivalent
Oscilloscope	Hewlett Packard 130B or equivalent
Oscillator	Hewlett Packard 200CD or equiv.
AC Vacuum Tube Voltmeter	Hewlett Packard 400DR or equiv.
Vacuum Tube Voltmeter	RCA Senior Voltohmyst or equiv.
Volt-Ohm Meter	Simpson 260 or equivalent
Frequency Counter	Hewlett Packard 522 or equivalent

4-4. PREVENTIVE MAINTENANCE.

4-5. VISUAL INSPECTION. Remove the filter, GOV-3/F, from the unit and unfasten the cover screws. Remove the aluminum cover from the VCO. Inspect all components for damage, such as broken or leaking parts. Look for burned or charred spots which often mean a faulty component.

4-6. CLEANING. Since cooling air is constantly flowing through the equipment, the main blower should be properly filtered. Corners and bottom of the equipment rack should be periodically cleaned with a standard vacuum cleaner. The panel and cover of the GOV-3 may be cleaned with Carbon Met or any other suitable solvent. Interior parts must be air blown.

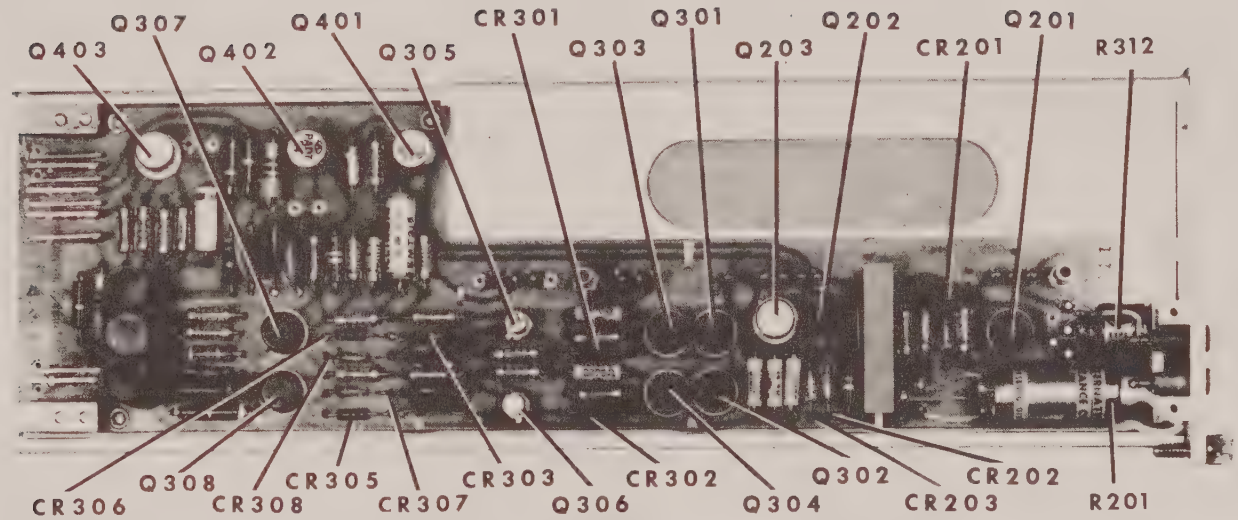


Figure 4-1. GOV-3 with cover removed and major components called out

4-7. LUBRICATION. No lubrication required.

4-8. TROUBLESHOOTING.

4-9. Primarily, troubleshooting consists of isolating a malfunction and pin pointing the problem to a specific component or coupling network. Typical waveforms and average voltages listed in Table 4-2 may be cross referenced to the pictorial illustration shown in Figure 4-2. When troubleshooting a malfunctioning unit it is recommended that voltages and waveforms be compared with a good unit. Replacement of any component in the GOV-3 should be done with the same type and manufacturer.

4-10. When a transistor is suspected of being faulty remove the printed circuit board from the chassis and proceed as follows:

a. Obtain a voltmeter and adjust the meter for continuity check. Set resistance at R X 100.

b. Turn the card over so the circuitry may be observed and locate the terminals of each transistor.

c. Place the test probes between the emitter and base; then reverse the positions of the probes. One of these positions should indicate forward bias.

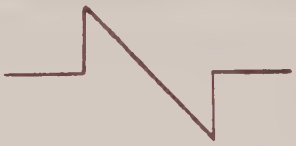
d. Continue checking between base-collector, base-emitter and emitter-collector.

e. If the meter does not deflect in any direction or deflects in both positions, the transistor is probably bad. Replace transistor.

f. Before replacing transistor examine associated circuitry to determine if any other component may have caused the damage to the transistor.

g. Examine all Elco pins to ensure that none have been bent or spread open.

Table 4-2. Waveforms and Locations

Location	Test Point		AC Volts	DC Volts
Q301 Collector Q302 Collector	1		0 V -6.5 V -13 V	-6.5 V
Q305 Base Q306 Base	2		-5 V -12.5 V	-8 V
Q305 Collector Q306 Collector	3		+6.0 V -1.0 V	+2.6 V
Q402 Emitter	4		+11.8 V +9.4 V	+10.4 V
Q403 Emitter	5		1.6 V P-P	+10 V
Q403 Collector	6		.5 V P-P	+.6 V

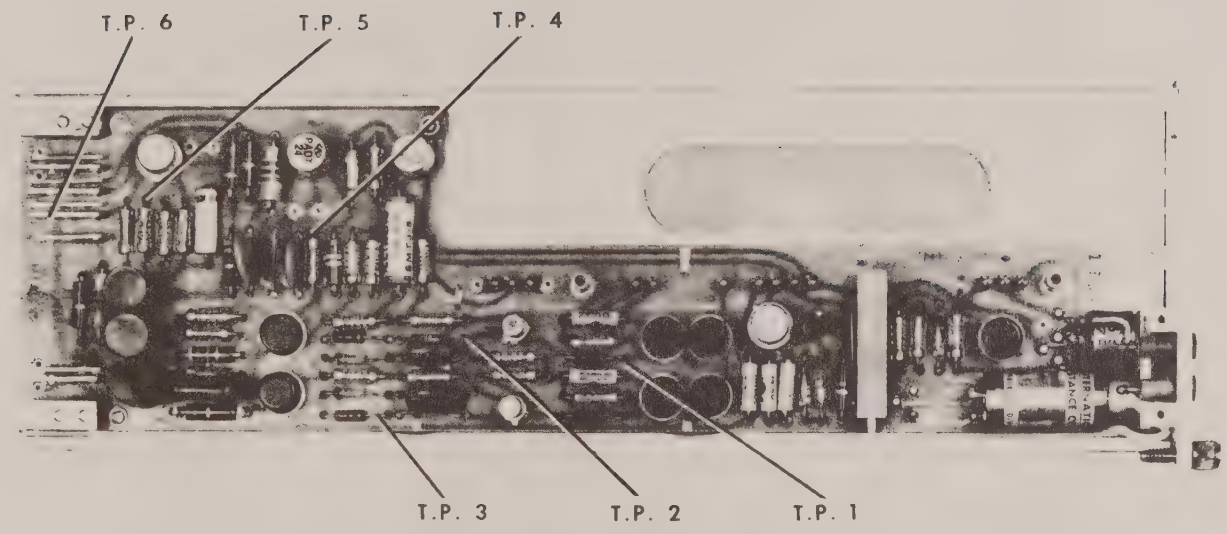


Figure 4-2. Test Points, GOV-3

Table 4-3. Recommended Spare Parts List, GOV-3

Item	Part Number	Description	Qty./3 units
1	R201	Potentiometer, A. B. #GA2G024S503 UA, 50 K	1
2	R312	Potentiometer, BD-011414	1
3	R101, R102	Resistor, A. B., 220 ohm, 1/2W, 10%	2
4	L101, L102	Coil, Delevan, 2500-28, ±5%, 1 mh	1
5	C101, C102	Capacitor, Int. Elec. #APS067, 8 uf, 50 V	1
6	Q201	Transistor, T.I. SM1036A	1
7	Q202	Transistor, Sperry 66P.2	1
8	Q203	Transistor, Sperry 66P.2	2
9	Q301 - Q304	Transistor, Motorola MM487	4
10	Q305, Q306	Transistor, Motorola 2N2257	2
11	Q307, Q308	Transistor, G.E. 4JX40605	2
12	Q401, Q402	Transistor, Amperex PADT24	4
13	Q403	Transistor, 2N414	1
14	CR202, CR203 CR307, CR308	Diode, Clevite CGD1032	4
15	CR301, CR302 CR305, CR306	Diode, Fairchild IN3067	4
16	CR303, CR304	Diode, Cont. Devices IN715A	2

ERRATA

ALL REPLACEMENT PARTS LISTS

All resistors that are Texas Instrument, CG1/4, 1/4W, 1% are interchangeable with Electra, MF5C-D, 1/4W, 1%.

Table 4-4. Replacement Parts List

DCS Model GOV-3 Nomenclature: Voltage Controlled Oscillator

Item No.	Symbol No.	Part Description	Manufacturer's Part Number	Manufacturer's Name	Qty/ Item	Spares Recm'd*	Qty / Spk **	Remarks
1		Final Assembly	CA-009607	D.C.S.				
2	R201	Potentiometer	GA2G024S503	Allen Bradley	1	1	1	Used in Item #1
			UA, 50 K					
3	R312	Potentiometer	BD-011414	IRC	1		1	" " " "
4		Front Panel Assembly	BA-009570	D.C.S.	1			
5		Mother Board Assembly	GA-009680	D.C.S.	1			
6	L101	Coil 1mh	,2500-28, 5%,	Delevan	2	.5	1	Used in Item #5
7	L102	Coil 1mh	2500-28, 5%,	Delevan		.5		" " " "
8	R101	Resistor MS35043	CB, 1 4W,	Allen Bradley	2	.2	2	" " " "
			10%, 220 ohms					
9	R102	Resistor MS35043	CB, 1/4W	Allen Bradley		.2		" " " "
			10%, 220 ohms					
10	R103	Resistor MS35043	CB, 1/4W	Allen Bradley	1	.2		" " " "
			10%, 1 K					
11	R104	Resistor MS35043	CB, 1/4W	Allen Bradley	1	.2		" " " "
			10%, 3.3 K					
12	R202	Resistor MF5C-D	5112F	Electra	1	.2		" " " "
			51.1K					
13	R204	Resistor MF5C-D	1/4W,	Electra	1	.2		" " " "
			1%, 1.0 M					
14	R205	Resistor MF5C-D	8252F	Electra	1	.2		" " " "
			82.5K					
15	R206	Resistor MS35043	CB, 1/4W,	Allen Bradley	1	.2		" " " "
			10%, 22 K					
16	R207	Resistor	MF5C-C,6812F,	Electra	1	.2		" " " "
			68.1 K					

*Spares for 1 unit per 10,000 hrs. con't. operation

**Qty. per 3 units

Table 4-1. Replacement Parts List (continued)

DCS Model GOV-3 Nomenclature Voltage Controlled Oscillator

Item No.	Symbol No.	Part Description	Manufacturer's Part Number	Manufacturer's Name	Qty/ Item	Spares Recm*	Qty Spk **	Remarks
17	R208	Resistor MF5C-C	6812F, 68.1K	Electra	1	.2		Used in Item #5
			1332F, 13.3K					
18	R209	Resistor MF5C-C	6812F, 68.1K	Electra	1	.2		" " " "
			3161F, 3.16K					
19	R203	Potentiometer	RH104M, 100K,	Allen Bradley	1	1		" " " "
20	R301	Resistor MF5C-D	5622F,	Electra	2	.2		" " " "
			56.2K					
21	R302	Resistor MF5C-D	5622K,	Electra		.2		" " " "
			56.2K					
22	R303	Resistor MF5C-D	2372,	Electra	2	.2		" " " "
			2.37K					
23	R304	Resistor MF5C-D	2372,	Electra		.2		" " " "
			2.37K					
24	R305	Resistor MF5C-D	4642,	Electra	2	.2		" " " "
			46.4K					
25	R306	Resistor MF5C-D	4642,	Electra		.2		" " " "
			46.4K					
26	R307	Resistor MF5C-D	1212F,	Electra	2	.2		" " " "
			12.1K					
27	R308	Resistor MF5C-D	1212F,	Electra		.2		" " " "
			12.1K					
28	R309	Resistor MF5C-D	1331F,	Electra	2	.2		" " " "
			1.33K					
29	R310	Resistor MF5C-D	1331F.	Electra		.2		" " " "
			1.33K					
30	R311	Resistor MF5C-D	3161F,	Electra	1	.2		" " " "
			3.16K					

*Spares for [illegible]

Table 4-4. Replaceme Parts List (continued)

DCS Model GOV-3 Nomenclature Voltage Controlled Oscillator

Item No.	Symbol No.	Part Description	Manufacturer's Part Number	Manufacturer's Name	Qty/ Item	Spares Recm*	Qty Spl**	Remarks
31	R313	Resistor MF5C-D	1332F,	Electra	1	.2		Used in Item #5
			13.3K					
32	R314	Resistor MS35043	CB, 1/4W	Allen Bradley	1	.2		" " "
			10%, 47 K					
33	R315	Resistor MF5C-D	1/4W, 1%	Electra	1	.2		" " "
			1.47K					
34	R401	Resistor	MF5C-D,	Electra	1	.2		" " "
			2151F, 2.15K					
35	R402	Resistor	MF5C-D,	Electra	1	.2		" " "
			1782F, 17.8K					
36	R403	Resistor	MF5C-D,	Electra	1	.2		" " "
			4642F, 46.4K					
37	R404	Resistor	MF5C-D,	Electra	2	.2		" " "
			1212F, 12.1K					
38	R405	Resistor MS35350	MF5C-D, 10%	Electra	1	.5		" " "
			1/4W, 12.7 K					
39	R406	Resistor MF5C-F	1/4W, 1%	Electra	1	.2		" " "
			6.81K					
40	R407	Resistor MS35350	CG, 1/4W,	Texas Instr.	1	.2		" " "
			1%, 382ohms					
41	R408	Resistor MF5C-D	D-3481F	Electra	2	.2		" " "
			3.48K					
42	R409	Resistor MF5C-D	D-3481F,	Electra		.2		" " "
			3.48K					
43	R410	Resistor MF5C-D	D-1960F,	Electra	1	.2		" " "
			1960hms					

*Spares for 1 unit per 10,000 hrs. con't. operation

**Qty. per 3 units

Table 4-4 Replacement Parts List (continued)

DCS Model GOV-3 Nomenclature Voltage Controlled Oscillator

Item No.	Symbol No.	Part Description	Manufacturer's Part Number	Manufacturer's Name	Qty Item	Spares Recm*	Qty Spk**	Remarks
44	C101	Capacitor	APS067, 50V.	I.E.I.	3	.5	1	Used in Item #5
			8 uf					
45	C102	Capacitor	APS067, 50V,	I.E.I.		.5		" " " "
			8 uf					
46	C103	Capacitor	APS067, 50V.	I.E.I.		.5		" " " "
			8 uf					
47	C301	Capacitor	TA, 100V,	RMC Discap	1	.1		" " " "
		+80%,	-20%, .02uf					
48	C303	Capacitor	JF-350 $^{+80}_{-20}$%,	RMC Discap.	2	.1		" " " "
			1000V, 500mf					
49	C304	Capacitor	JF-350, $^{+80}_{-20}$%	RMC Discap.		.1		" " " "
			1000V, 500mf					
50	C401	Capacitor	SMT215, 15V.	Illinois	1	.5		" " " "
			2 uf					
51	C402	Capacitor	150D, 20V.	Sprague	1	.5		" " " "
			20%, 1 uf					
52	C403	Capacitor	TA,STD TOL.	RMC Discap.	2	.5		" " " "
			100V, .02 uf					
53	C404	Capacitor	V84B, 20%,	Aerovox	1	.5		" " " "
			150 V, .01 uf					
54	C405	Capacitor	TA,STD TOL	RMC Discap.		.5		" " " "
			100 V, .02 uf					
55	CR201	Diode	IN3067	Fairchild	1	1		" " " "
56	CR202	Diode	CGD1032	Clevite	2	1	4	" " " "
57	CR203	Diode	CGD1032	Clevite		1		" " " "
58	CR301	Diode	IN3067	Fairchild	4	1		" " " "
59	CR302	Diode	IN3067	Fairchild		1		" " " "

*Spares for unit per 10.0[illegible] con't [illegible]

Table 4-4. Replacement Parts List (continued)

DCS Model GOV-3 Nomenclature. Voltage Controlled Oscillator

Item No.	Symbol No.	Part Description	Manufacturer's Part Number	Manufacturer's Name	Qty/ Item	Spares Recm*	Qty/ Spk **	Remarks
60	CR303	Diode	IN715A	Cont. Devices	2	1	2	Used in Item #5
61	CR304	Diode	IN715A	Cont. Devices		1		" " " "
62	CR305	Diode	IN3067	Fairchild		1		" " " "
63	CR306	Diode	IN3067	Fairchild		1		" " " "
64	CR307	Diode	CGD1032	Clevite	2	1		" " " "
65	CR308	Diode	CGD1032	Clevite		1		" " " "
66	Q201	Transistor	2N3390	G. E.	1	1	1	" " " "
67	Q202	Transistor	MM999	Motorola	2	1	1	" " " "
68	Q203	Transistor	MM999	Motorola		1	2	" " " "
69	Q301	Transistor	2N3856A	G. E.	4	1	4	" " " "
70	Q302	Transistor	2N3856A	G. E.		1		" " " "
71	Q303	Transistor	2N3856A	G. E.		1		" " " "
72	Q304	Transistor	2N3856A	G. E.		1		" " " "
73	Q305	Transistor	2N2257	Motorola	2	1	2	" " " "
74	Q306	Transistor	2N2257	Motorola		1		" " " "
75	Q307	Transistor	TN53	Sprague	2	1	2	" " " "
76	Q308	Transistor	TN53	Sprague		1		" " " "
77	Q401	Transistor	PADT24	Amperex	2	1	4	" " " "
78	Q402	Transistor	PADT24	Amperex		1		" " " "
79	Q403	Transistor	2N414	RCA	1	1	1	" " " "
80	R316	Resistor	EB, 1/2W, 5%, F.A.	Allen Bradley	1			

*Spares for 1 unit per 10,000 hrs. con't. operation

**Qty. per 3 units

SECTION V

DRAWINGS

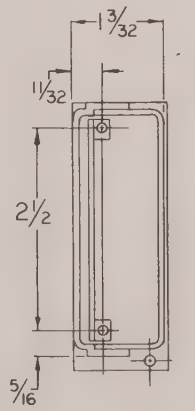
5-1. GENERAL. The drawings listed in this section are furnished to supplement the information given in the text.

DO-009567	Outline Drawing, GOV-3
DW-009553	Schematic, GOV-3

REVISIONS					
SYM.	DESCRIPTION	DATE	BY	CHK'D	APP'D
B	UPDATE DWG. PER CA 3047	10/4/65	WB	WJ	WJ

NOTES:

1) THE GOV-3 PLUGS INTO THE DCS MODEL GMA-1 MODULE ASSEMBLY. ALL POWER AND SIGNAL CONNECTIONS ARE MADE FROM GMA-1 TO GOV-3 VIA ELCO CONNECTORS AS TABULATED.
2) THE GOV-3 CONTAINS A COMPARTMENT TO ACCEPT THE PLUG-IN FREQUENCY UNIT MODEL GOV-3/F (NOT PART OF GOV-3).

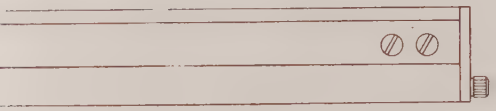


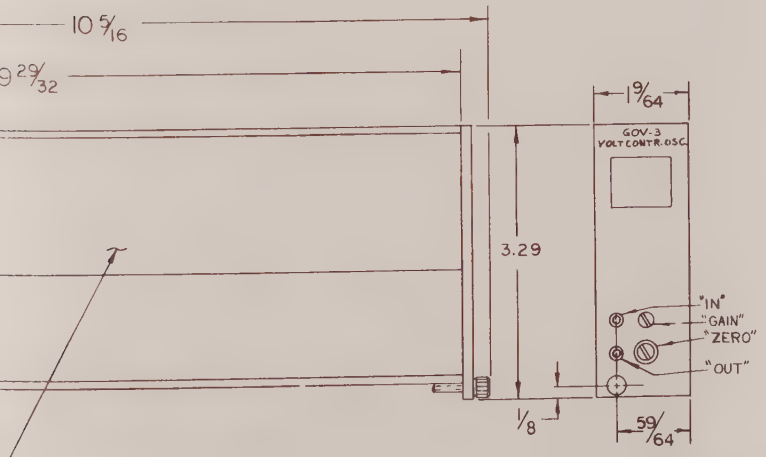
COMPARTMENT FO

REF	DESCRIPTION	QTY

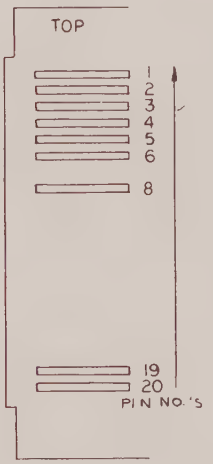
DO-009567 | 00

PIN NO.	DESCRIPTION
1	SIGNAL LEAD, INPUT
2	SIGNAL LEAD INPUT (INTERNAL GND)
3	+ 35 VOLTS D.C.
4	+ 12 VOLTS D.C.
5	GROUND
6	SUMMING BUS
7	
8	- 35 VOLTS D.C.
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	SIGNAL LEAD OUTPUT
20	GROUND (OUTPUT GND)





GOV-3/F



PIN CONN (SEE TAB)

SYMBOL	ITEM	DWG NO	DESCRIPTION	QTY / ASSY

DATA-CONTROL SYSTEMS, INC.

TITLE: OUTLINE, GOV-3 VOLTAGE CONTR. OSC.

TOLERANCE	SCALE	DATE	DO NOT SCALE DRAWING
DEC ± .02 FRAC ± 1/32	DWN MB	10/4/65	MAT'L
NOTE: BREAK ALL SHARP CORNERS	CHKD	10/4/65	FINISH
	PROJ ENG	10/4/65	MODEL
	NEXT ASSY	CH ENG	DO-009567 REV. B

PRODUCT	NEXT ASSY	QTY
GOV-3		

REV	DATE	DESCRIPTION	BY	CHK	APP
P	9/12/64	CA-2438-C301 WAS 8200 μf	MW		
R	7/6/65	CA-2935-COMPONENT ADJ ARE CA			
S	8/26/65	CA-2778-Q201 WAS 2N 706			
T	2/8/66	CA-3222 NOTE 7 ADDED, C1201 & C1202 TO SCHEMATIC	JB		
U	3/3/66	CA-3330-CHG'D. RES. R405 VALUE	P.B		
V	5/9/66	CA-3358-CHG'D Q301, 302, 303, 304	P.I		
W	7/6/66	CA-3467-CHG'D. R407 VALUE	PT		
X	5/17/66	CA-2778-2 ADD R 210			
Y	5/31/67	CA-3937 CHG RES. VALUES			
Z	9/14/67	CA-3915 CHG'D CAP VALUES			

INPUT MONITOR JACK.

R209 10W, 1% 3.16K

CR203 CDG1032 CR202

-23V

R205 82.5K

Q202 MM999

Q203 MM999

-.9V

-.1V

CR201 IN3067

R210 2KΩ ½W 1%

SEE NOTE 4

C1202 FA SEE NOTE

R1203A (D.S.) S1201

R1203 (D.S.)

C1201 FA SEE NOTE 7

R1201 D.S.

R1202 (D.S.)

R201 50K

R202 51.1K

SENSITIVITY

INPUT

SIGNAL GRD

Q201 2N3390

R204 1.00M

R203 TRIMMER 100K

R410 196Ω

+6V .5V P-P SINEWAVE OUTPUT

Q403 2N419

FILTER

OUTPUT MONITOR JACK

10.2V 1.4V P-P SINE WAVE

C405 .02 MF

R407 383Ω

C404 .01 MF

R408 3.40K

R409 3.48K

R207 68.1K

R208 13.3K

R206 * 22K

HIGH LE OUT GN

HIGH LEV OUT

A. ALL VOLTAGES MEASURED WITH RCA SENIOR VOLT OHMYST MODEL WV-98A

B. ALL WAVE FORMS TAKEN WITH 10 MEGOHM 14 MMF SCOPE PROBE.

C. ALL VOLTAGES AND WAVEFORMS TAKEN WITH THE INPUT SHORTED AND THE ZERO POT 2½ TURNS CLOCKWISE.

ELCO PIN NO.

△ ELCO CONNECTORS TO GMA

□ ELCO CONNECTORS IN TUNING UNIT (GOV-3/F)

○ ELCO CONNECTORS IN GOV-3 FOR TUNING UNIT (GOV-3/F)

NOTES:

1) * RESIST ALL OT

2) (D.S.) = DE

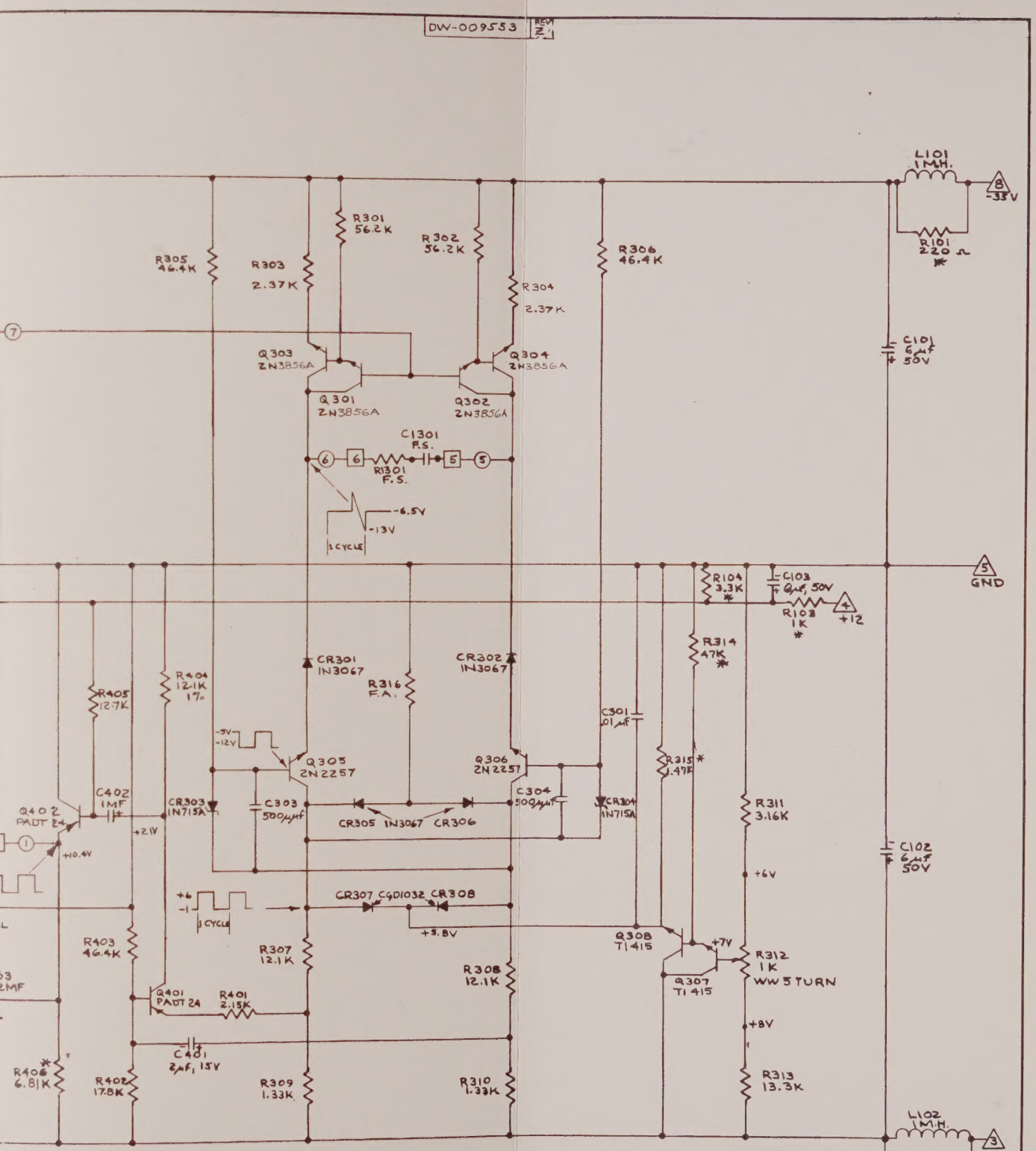
3) COMPON

4) R1203A

4) (F.S.) = FI

REV.	DESCRIPTION	QTY

DW-009553 REV Z



RS ARE A.B, CB, 1/4 W, 10%
ER RESISTORS ARE 1/4, 1%
ATION SENSITIVITY ADJUSTMENTS.
NTS 1000$ UP IN GOV-3/F.
& S1201 IN GOV-3/FS ONLY.

EQUENCY SENSITIVE ADJUSTMENTS.

PATENT APPLIED FOR

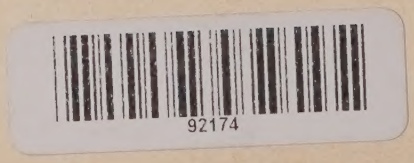
SYMBOL	ITEM	DWG. No.	DESCRIPTION	QTY / ASSY

DATA-CONTROL SYSTEMS, INC.

TITLE: SCHEMATIC, GOV-3

TOLERANCE	SCALE NONE	DATE	DO NOT SCALE DRAWING
DEC. ±.005	DWN. R.E.	12/8/64	MAT'L
FRAC. ±1/64	CHKD.	12-18-64	FINISH
ANG. ±0°30'	PROJ.	12/18/64	MODEL
NOTE: BREAK ALL SHARP CORNERS	ENG.	12/18/64	GOV-3
NEXT ASSY.	CH. ENG.	12/18/64	DW-009553 Z

GOV-3 PROD | BA-012 846 NEXT ASSEMBLY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